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Dynamical models of the dwarf spheroidal galaxies Fornax

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In the standard Λ cold dark matter (ΛCDM) cosmological model, dwarf galaxies are considered the building blocks of the most massive galaxies, so a knowledge of their properties is required to understand the processes that drive galaxy formation. Among dwarf galaxies, the local dwarf spheroidal galaxies (dSphs) are known to be hosted in massive and extended dark halos, usually dominating the stellar components even in the central parts. dSphs almost completely lack mission in bands other than the optical, so they are natural locations at which to look for high-energy signals from annihilating or decaying dark-matter particles. These facts make dSphs ideal laboratories in which to study dark matter and to test cosmology on the smallest scales, where there is potential tension between the observational data and the predictions of the ΛCDM model. I present new dynamical models of dwarf spheroidal galaxies (dSphs) in which both the stellar component and the dark halo are described by analytic distribution functions that depend on the action integrals. In their most general form these distribution functions can represent axisymmetric and possibly rotating stellar systems. I model the Fornax dSph, limiting for simplicity, to the non rotating, spherical case. The models are compared with state-of-the-art spectroscopic and photometric observations of Fornax, exploiting the knowledge of the line-of-sight velocity distribution of the models, using measures of individual stars, and accounting for the foreground contamination from the Milky Way. The model that best fits the structural and kinematic properties of Fornax has a cored dark halo, with a large core in the inner parts of the dark halo density distribution. The stellar velocity distribution is isotropic almost over the full radial range covered by the spectroscopic data and slightly radially anisotropic in the outskirts of the stellar distribution. The dark-matter annihilation J-factor and decay D-factor, useful tool to employ in the search for inderect dark matter signals, have also been computed. This cored halo model of Fornax is preferred, with high statistical significance, to both models with a Navarro, Frenk and White dark halo and simple mass-follows-light models.

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